In the Clean Copy of the Specification

Kindly replace paragraph [0011] with the following:

[0011] The term "substantially" implies that a third phase (other than ferrite and the low temperature-transforming phase) having a volute fraction of less than 5% is allowed to exist. As the third phase, for example, ~~perlite~~ pearlite, cementite, or retained austenite may be mentioned.

Kindly replace paragraphs [0017]-[0021] with the following:

[0017] Major properties required for an expandable steel pipe are that pipe expansion can be easily performed, that is, can be performed using little energy, and that in pipe expansion even at a high expansion ratio, a steel pipe is not likely to be unevenly deformed so that uniform deformation is obtained. To perform easy pipe expansion, a low YR (YR: yield ratio = yield strength YS/tensile strength TS) is preferable and, in addition, to obtain uniform deformation even at a high expansion ~~ration~~ ratio, a high uniform elongation and a high work-hardening coefficient are preferred.

[0018] We found that a preferable microstructure of a steel pipe substantially contains ferrite (volume fraction of 5% or more) + a low temperature-transforming phase (bainite, martensite, bainitic ferrite, or a mixture containing at ~~leat~~ least two thereof) and, hence, carried out experiments to realize the microstructure described above.

[0019] First, the content of C was controlled to be less than about 0.1% to suppress the formation of ~~perlite~~ pearlite and increase the toughness, Nb was further added which was an element having the effect of delaying transformation and, subsequently, the content of Mn forming a microstructure containing ferrite and a low temperature-transforming phase was examined. Formation of a predetermined microstructure by cooling a pipe from a γ region was defined as an essential condition, and by the use of a steel pipe having an external diameter of 4" to 9⅝" and a wall thick-ness of 5 to 12 mm, which has been applied to an expandable steel pipe, as the standard pipe, we obtained a predetermined microstructure by a cooling rate which is generally applied to the size of the steel pipe described above. Although depending on the cooling circumstances, the average cooling rate is approximately 0.2 to approximately 2°C/sec in the range of approximately 700 to approximately 400°C.

[0020] As a result, it was found that, when the content of Mn is about 2% to about 4%, ferrite is formed and a low temperature-transforming phase is formed without forming ~~perlite~~ pearlite. In addition, it was also found that when a predetermined amount of Mo or Cr, which is also an element having the effect of delaying transformation, is added instead of Nb, the same effect as described above is obtained.

[0021] We also found that, when the content of Mn is controlled to be about 0.5% or more, and an alloying element is added so that equation (1) or (3) holds, the formation of ~~perlite~~ pearlite is suppressed. In addition, it was also disclosed that, since a ferrite microstructure is no longer formed when a large amount of an alloying element is added, the addition thereof must be performed to satisfy equation (2) or (4) for forming a ferrite microstructure. That is, by satisfying both equations, a microstructure containing ferrite and a low temperature-transforming phase can be formed and, hence, a steel pipe having a high expand ratio and a low YR can be obtained:

$$Mn+0.9\times Cr+2.6\times Mo\geq 2.0 \quad (1)$$

$$4\times C-0.3\times Si+Mn+1.3\times Cr+1.5\times Mo\leq 4.5 \quad (2)$$

$$Mn+0.9\times Cr+2.6\times Mo+0.3\times Ni+0.3\times Cu\geq 2.0 \quad (3)$$

$$4\times C-0.3\times Si+Mn+1.3\times Cr+1.5\times Mo+0.3\times Ni+0.6\times Cu\leq 4.5 \quad (4).$$

In the above equations, the symbol of an element represents the content (mass percent) of the element contained in the steel.

Kindly replace paragraph [0024] with the following:

[0024] We also found that when Q/T treatment, which is considered as a preferable process in conventional techniques is not intentionally ~~use~~ used, and steel containing an alloying component (including equation) is used which is in an as-rolled state or which is processed by a nonthermal-refining type heat treatment, the steel can be easily expanded although having a high strength, and that a high expansion ratio can be realized. We also believe that the properties described above can be obtained since the microstructure thus obtained contains ferrite and a low temperature-transforming phase.

Kindly replace paragraph [0026] with the following:

C: about 0.010% to less than about 0.10%

[0026] To achieve the formation of a dual-phase microstructure containing ferrite and a low temperature-transforming phase by a general seamless pipe-forming process, low C-high Mn-Nb based steel or steel which contains at least one of an alloying element instead of high Mn and an element (Cr, Mo) instead of Nb must be used, in which the alloying element satisfies the equation (3) and the element (Cr, Mo) has an effect of delaying transformation similar to that of Nb. However, when C is about 0.10% or more, ~~perlite~~ pearlite may be formed and, on the other hand, when C is less than about 0.010%, the strength becomes insufficient. Hence, the content of C is set in the range of about 0.010% to less than about 0.10%.

Kindly replace paragraphs [0035]-[0038] with the following:

Nb: about 0.01% to about 0.2%

[0035] Nb is an element suppressing formation of ~~perlite~~ pearlite and contributes to formation of a low temperature-transforming phase in a composite containing high C and high Mn. In addition, Nb contributes to the increase in strength by formation of a carbonitride. However, when the content is less than about 0.01%, the effect cannot be obtained and, on the other hand, when the content is more than about 0.2%, in addition to the saturation of the effect described above, formation of ferrite is also suppressed so that formation of a dual-phase microstructure containing ferrite and a low temperature-transforming phase is suppressed. Hence, the content of Nb is set in the range of about 0.01% to about 0.2%.

Mo: about 0.05% to about 0.5%

[0036] Mo forms a solid solution and carbide and has an effect of increasing strength at room temperature and at a high temperature. However, when the content is more than about 0.5%, in addition to the saturation of the effect described above, the cost is increased. Hence, Mo at a content of about 0.5% or less may be added. To efficiently obtain the effect of increasing strength, the content is preferably set to about 0.05% or more. In addition, as an element having an effect of delaying transformation, Mo has an effect of suppressing formation of ~~perlite~~ pearlite and, to efficiently obtain the effect described above, the content is preferably set to about 0.05% or more.

Cr: about 0.05% to about 1.5%

[0037] Cr suppresses formation of ~~perlite~~ pearlite, contributes to formation of a dual-phase micro-structure containing ferrite and a low temperature-transforming phase, and contributes to the in-crease in strength by hardening of the low temperature-transforming phase. However, when the content is less than about 0.05%, the effect cannot be obtained. On the other hand, even when the content is increased to more than about 1.5%, in addition to the saturation of the above effect, formation of ferrite is also suppressed and, as a result, formation of a dual-phase microstructure is suppressed. Hence, the content of Cr is set to about 0.05% to about 1.5%.

[0038] Under the conditions in which at least one of Nb, Mo, and Cr is contained and the content of a low C is less than about 0.1%, in view of the suppression of formation of ~~perlite~~ pearlite, equation (3) should be satisfied and, in addition, in view of the promotion of formation of ferrite at a volume fraction of about 5% to about 70%, equation (4) should be satisfied.

Kindly replace Tables 3 and 4 on pages 23 and 24 with the following:

Table 3

Steel pipe no.	Steel no.	Rolling finish temperature /°c	Heat treatment	Substantial microstructure	α Fraction/ volume %	Tensile properties					Rate of wall-thickness deviation before pipe expansion /%	Rate of wall-thickness deviation after pipe expansion /%	Limit of expansion ratio /%	Remarks
						YS /MPa	TS /MPa	YR /%	u-El /%	El /%				
11	E	860	Normalizing treatment	α + Low temperature-transforming phase	17	542	834	65	16	36	4.2	9.2	57	Example
11'	E	860	Dual-phase region II	α + Low temperature-transforming phase	34	452	780	58	19	38	3.7	8.7	53	Example
12	F	900	-	α + Low temperature-transforming phase	9	666	952	70	13	29	2.8	7.8	53	Example
13	F	760	Normalizing treatment	α + Low temperature-transforming phase	10	649	940	69	14	30	3.8	8.4	53	Example
14	G	840	-	Low temperature-transforming phase	-	470	546	86	10	31	7.2	12.0	28	Comparative example
15	H	825	-	α + ~~Perlite~~ Pearlite + low temperature-transforming phase	37	514	650	79	12	35	3.8	8.5	33	Comparative example
16	H	740	-	α + ~~Perlite~~ Pearlite + low temperature-transforming phase	51	571	705	81	11	31	5.5	10.0	28	Comparative example
17	I	825	-	α + ~~Perlite~~ Pearlite + low temperature-transforming phase	32	434	543	80	16	40	7.1	12.0	33	Comparative example
18	I	825	Q/T Treatment	Tempered martensite	-	626	688	91	9	34	7.1	11.8	31	Comparative example
19	J	830	-	α + ~~Perlite~~ Pearlite	62	504	586	86	14	39	4.4	9.0	36	Comparative example
20	J	830	Q/T Treatment	Tempered martensite	-	599	642	93	7	32	4.4	9.2	33	Comparative example

α: Ferrite, YS: Yield Strength, TS: Tensile Strength, YR: Yield Ratio, u-El: Uniform Elongation, El: Elongation

Table 4

Steel Pipe no.	Steel no.	Rolling finish temperature /°c	Heat treatment	Substantial microstructure	α Fraction/ volume %	Tensile properties					Rate of wall-thickness deviation before pipe expansion /%	Rate of wall-thickness deviation after pipe expansion /%	Limit of expansion ratio /%	Remarks
						YS /MPa	TS /MPa	YR /%	u-El /%	El /%				
21	K	830	-	α + Low temperature-transforming phase	38	456	702	65	17	38	3.8	8.8	48	Example
22	K	750	Normalizing treatment	α + Low temperature-transforming phase	36	462	689	67	18	39	4.2	9.1	50	Example
23	K	830	Dual-phase region IV	α + Low temperature-transforming phase	48	360	631	57	20	42	3.8	8.8	55	Example
24	L	825	-	α + Low temperature-transforming phase	36	439	708	62	17	37	3.0	7.9	50	Example
25	L	760	Dual-phase region II	α + Low temperature-transforming phase	42	373	678	55	19	39	2.1	7.1	53	Example
26	M	815	-	α + Low temperature-transforming phase	19	624	892	70	14	31	6.4	11.3	45	Example
27	M	800	Normalizing treatment	α + Low temperature-transforming phase	21	577	888	65	15	32	5.7	10.6	48	Example
28	N	820	-	α + Low temperature-transforming phase	42	450	693	65	19	39	3.8	8.7	53	Example
29	N	730	Normalizing treatment	α + Low temperature-transforming phase	40	458	684	67	18	38	4.2	9.1	55	Example
30	N	830	Dual-phase region IV	α + Low temperature-transforming phase	49	386	655	59	20	41	2.7	7.7	57	Example
31	O	830	-	Low temperature-transforming phase	-	791	953	83	7	21	3.1	8.0	28	Comparative example
32	P	820	-	α + ~~Perlite~~ Pearlite + low temperature-transforming phase	46	523	654	80	15	34	5.4	10.4	30	Comparative Example
33	P	730	Normalizing treatment	α + ~~Perlite~~ Pearlite + low temperature-transforming phase	41	503	637	79	16	35	5.4	10.3	33	Comparative Example

α: Ferrite, YS: Yield Strength, TS: Tensile Strength, YR: Yield Ratio, u-El: Uniform Elongation, El: Elongation